Dissertation on

ANTERIOR CHAMBER ANGLE EVALUATION BY ULTRASOUND BIOMICROSCOPY AND GONIOSCOPY IN PRIMARY ANGLE CLOSURE DISEASE

Submitted in partial fulfillment of requirements of

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CERTIFICATE

This is to certify that the dissertation entitled, "ANTERIOR CHAMBER ANGLE EVALUATION BY ULTRASOUND BIOMICROSCOPY AND GONIOSCOPY IN PRIMARY ANGLE CLOSURE DISEASE" submitted by Dr.J.JEEVITHA, in partial fulfillment for the award of the degree of Master of Surgery in Ophthalmology by The Tamilnadu Dr.M.G.R.Medical University, Chennai is a bonafide record of the work done by her in the Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Egmore, Chennai, during the academic year 2008 – 2011.

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CONTENTS

PART III

AIMS AND OBJECTIVES OF THE STUDY

To correlate the angle width measurements by Ultrasound biomicroscopy with gonioscopy.

To evaluate the changes in the anterior segment morphology in terms of biometric parameters following laser iridotomy.

To find out the demographic and ocular risk factors of angle closure glaucoma.

STUDY DESIGN

Prospective study

MATERIALS AND METHODS

Out of 285 patients referred to our glaucoma clinic as glaucoma suspects, 80 eyes of 43 subjects diagnosed to have primary angle closure mechanism were included in the study. The study was conducted in the Department of glaucoma, Regional Institute of Ophthalmology during the period of September 2008 to August 2010.

INCLUSION CRITERIA

Subjects with angles graded as grade 2 or less as per Shaffer's grading of anterior chamber angle were included.

Based on the clinical findings, they were categorised into three groups

- Primary angle closure suspects (PACS)
- Primary angle closure (PAC)
- Primary angle closure glaucoma (PACG)

EXCLUSION CRITERIA

- Primary open angle glaucoma
- Any forms of secondary glaucoma
- Congenital glaucoma

- Patients who have undergone intraocular surgery
- Prior history of laser procedure done
- Patients with any significant retinal pathology
- Prior history of ocular trauma

were excluded from the study.

All the subjects were examined in detail and glaucoma workup was done. Demographic data like age, sex and locality were included. Detailed history of presenting complaints like defective vision, headache, coloured halos, redness, pain, watering and history of any associated systemic conditions (diabetes mellitus and hypertension) were obtained. Family history of glaucoma and history of any topical or systemic medications and past history of ocular surgery, laser procedures and ocular trauma were obtained.

Best corrected visual acuity with refraction was done for all subjects. Intraocular pressure was recorded with Goldmann applanation tonometry and corrected for variations in central corneal thickness measured by ultrasonic pachymetry.

Slit lamp examinations including Van Herick's grading of anterior chamber, iris pattern and lens status were done. Stereobiomicroscopic

examination of optic disc was done using + 90D lens. Gonioscopy was carried out using a Goldmann single mirror gonioprism with low ambient illumination. In patients having steeper iris configuration, gonioscopy was done using four mirror Zeiss lens. Visual fields were plotted with Octopus 301 automated perimetry.

A-scan ultrasonic biometry was done to assess anterior chamber depth and axial length.

For all subjects, Ultrasound biomicroscopic (UBM) examination was done using UBM OTI scan 3000 model. UBM imaging was performed with the subject in the supine position in dim light illumination under topical anaesthesia.A plastic eyecup was used to gently part the lids and retain the normal saline as coupling solution. The probe was moved perpendicular to the structure to be scanned.

The following parameters were measured using UBM

1. *Trabecular-iris angle(TIA) or anterior chamber angle(ACA)*

   Measured with its apex at the iris recess and the arms of the angle passing through a point on the trabecular meshwork at 500microns from the scleral spur and the point on the iris perpendicularly opposite.

2. *Angle opening distance 500 (AOD 500)*

It is the distance between the posterior corneal surface and the anterior iris surface measured on a line perpendicular to the trabecular meshwork, 500microns anterior to scleral spur.

3. *Trabecular-ciliary process distance(TCPD)*

Measured on a line extending from the corneal endothelium at 500microns from the scleral spur perpendicular through the iris,to the ciliary processes.

4. *UBM-anterior chamber depth(ACD)*

It is depth from the corneal endothelium to the anterior lens surface.

All these parameters were measured in the temporal quadrant and taken for comparison with gonioscopic grading of temporal angle.

Out of 80 eyes of 43 subjects enrolled in the study, 70 eyes of 35 subjects underwent laser peripheral iridotomy (LPI). After getting informed consent, laser iridotomy was done for all these patients with occludable angles in superotemporal quadrant. Among 10 eyes in which

LPI not done, 4 eyes of PACS were kept under observation and for 6 eyes of PACG, surgery was advised.

After 2 weeks of LPI, vision and IOP were recorded.Slit lamp examination was done to determine Van Herick's grading of anterior chamber and patency and location of iridotomy.Gonioscopic angle evaluation was also done.

Repeat UBM was done to assess the changes in anterior segment morphology in terms of biometric parameters (TIA, AOD500, TCPD, ACD)

All these details were entered in the proforma for each patients. The datas were compiled and analysed.

ANALYSIS AND RESULTS

80 eyes of 43 subjects were included in the study.For 6 subjects only one eye was taken.

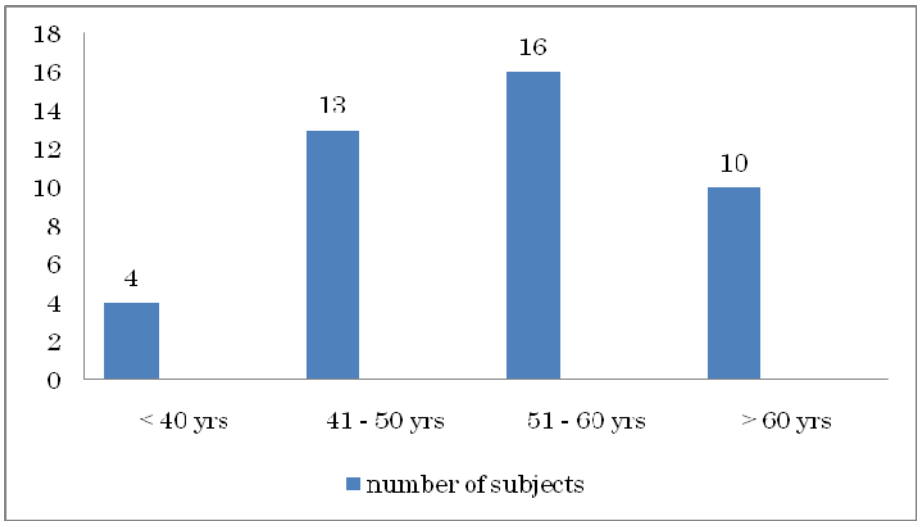
AGE DISTRIBUTION

AGE GROUP	NO OF SUBJECTS	PERCENTAGE
< 40 years	4	10%
41 – 50 years	13	30%
51 – 60 years	16	37%
>60 years	10	23%

SEX DISTRIBUTION

Out of 43 subjects, 21 (49%) were males and 22 (51%) were females.

AGE DISTRIBUTION



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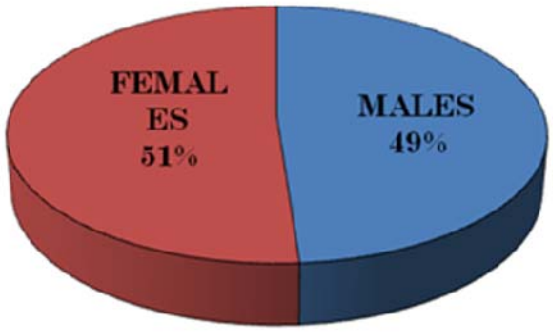
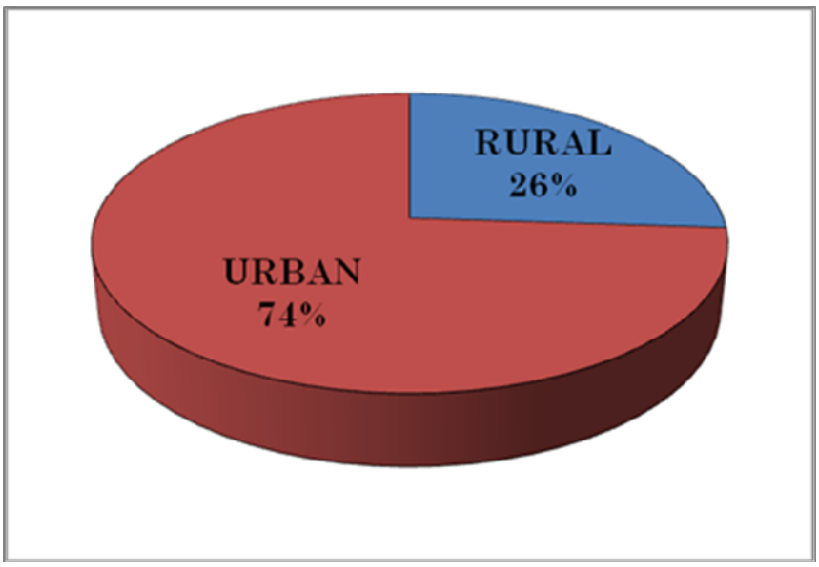


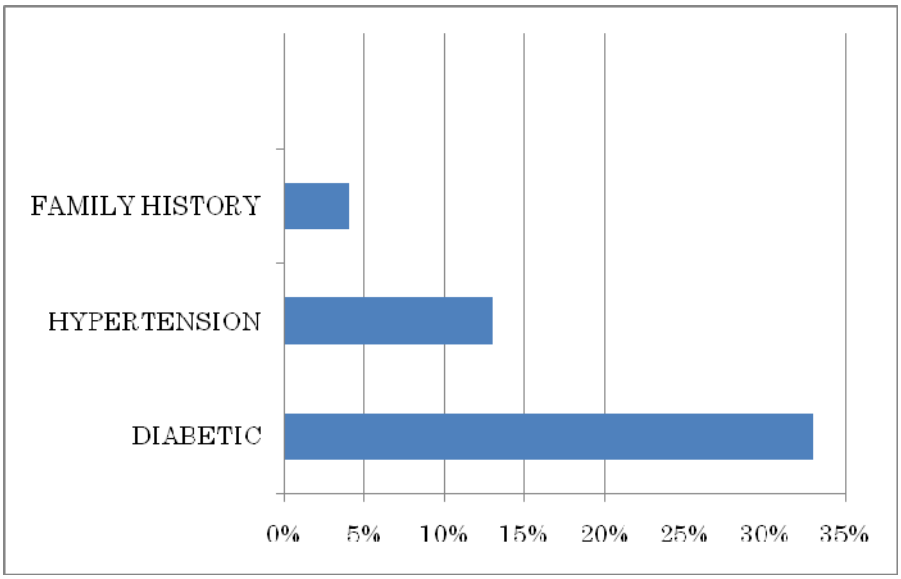
LOCALITY

11 out of 43 subjects (26%) were from rural area and rest 32 subjects (74%) were from urban area.



SYSTEMIC ASSOCIATIONS & FAMILY HISTORY

14 subjects (33%) of study group were diabetic and 6 (13%) were hypertensive. 2 subjects had a positive family history of glaucoma.



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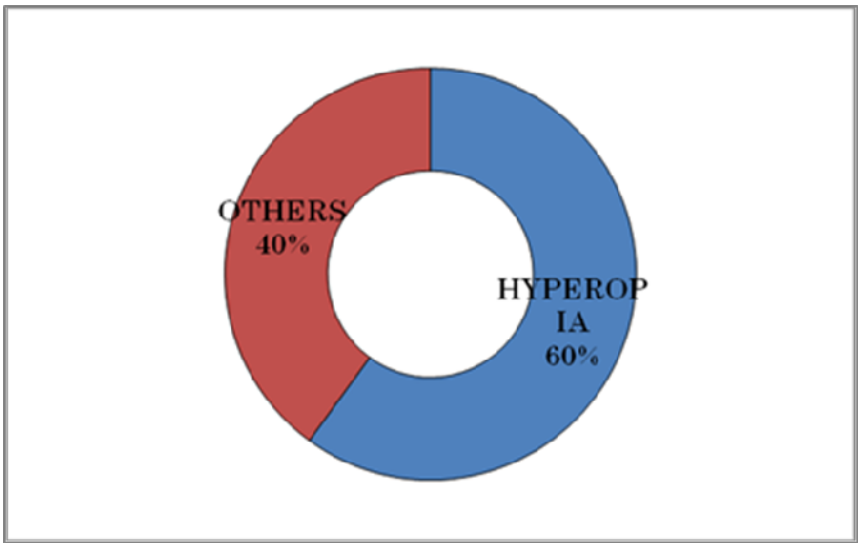
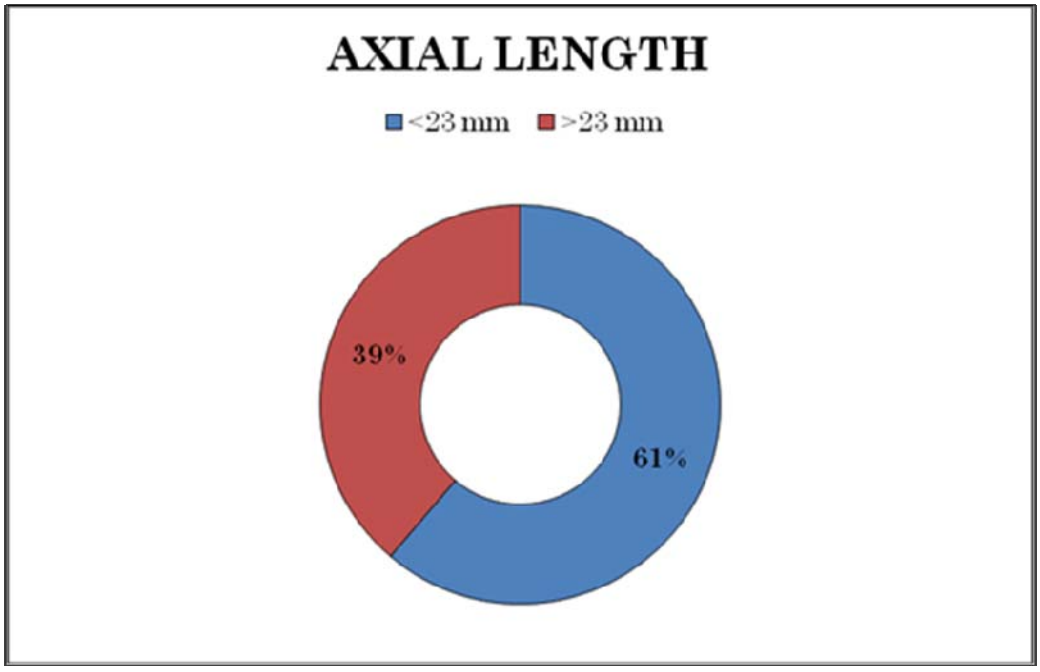
REFRACTIVE STATUS

On analysing the refractive status of each eye, 48 eyes (60%) were found to be hypermetropic. Other eyes had no refractive error or myopia or astigmatism.



AXIAL LENGTH

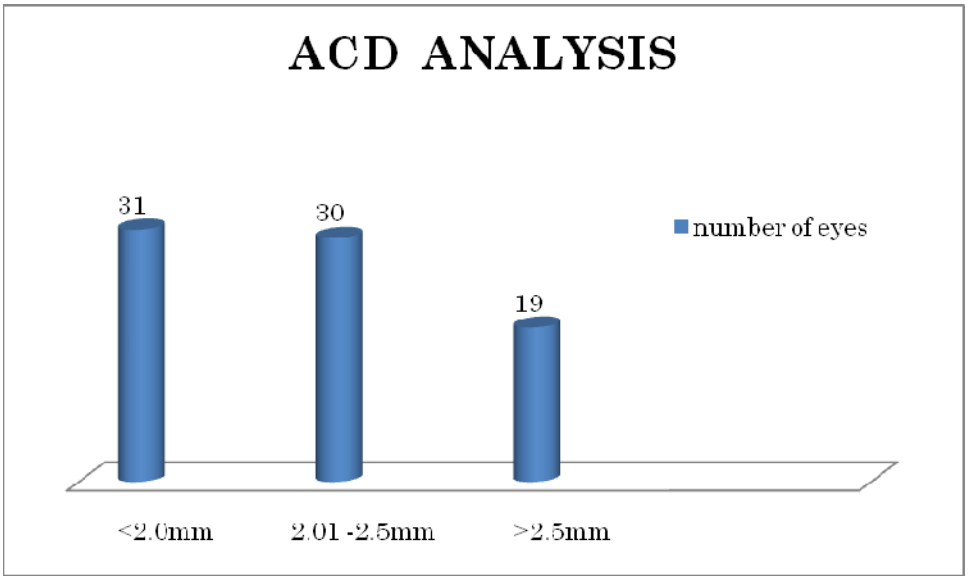
Based on the axial length measured with A-scan biometry, 49 eyes (61%) had axial length <23mm and 31 eyes (39%) had axial length >23mm. The shortest axial length was 21.06mm and the longest was 24.14mm.



CENTRAL ANTERIOR CHAMBER DEPTH (ACD)

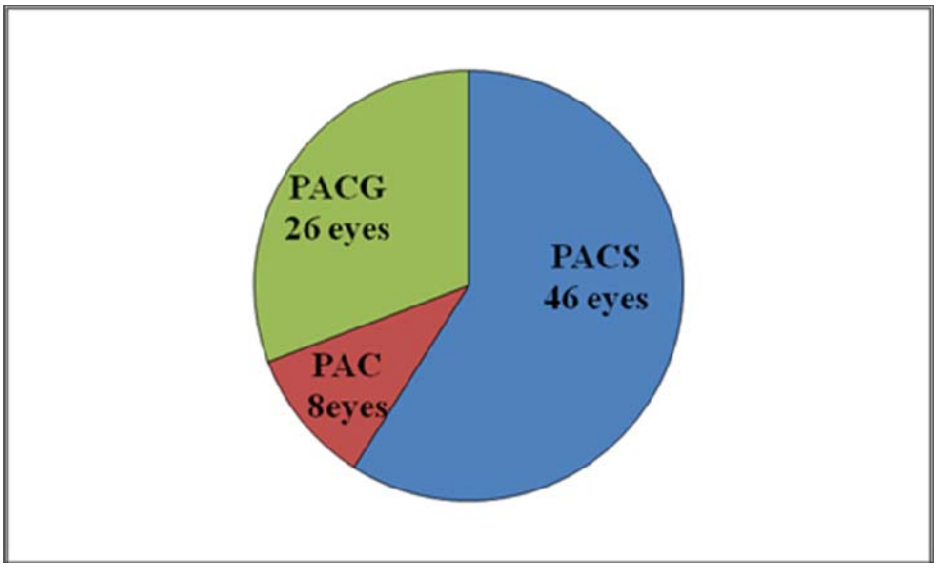
31 eyes (39%) had ACD <2.0mm, 30 eyes (37%) had ACD between 2.0mm to 2.5mm and 19 eyes (24%) had ACD >2.5mm.

The ACD was in the range of 1.04mm to 3.60mm with a mean ACD of 2.19mm with a standard deviation of 0.47.



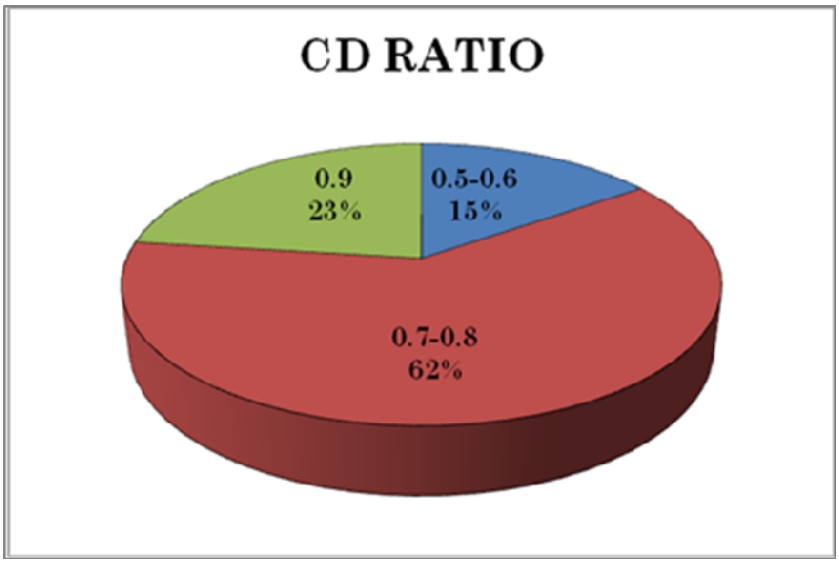
Based on the clinical findings, the eyes were categorised into Primary angle closure suspects (PACS), Primary angle closure (PAC) and Primary angle closure glaucoma (PACG).

	NUMBER OF EYES
PACS	46
PAC	8
PACG	26
TOTAL	80



Out of 26 eyes with PACG, 4 eyes had Cup disc (CD) ratio of 0.5 – 0.6, 16 eyes had Cup disc ratio of 0.7 – 0.8 and 6 eyes had Cup disc ratio of 0.9. All these patients had corresponding visual field defects.

CD Ratio	Number of eyes
0.5 – 0.6	4
0.7 – 0.8	16
0.9	6



GONIOSCOPY

On gonioscopic angle evaluation, temporal quadrant of 12 eyes had closed angle, 42 eyes had grade 1 and 26 eyes had grade 2 as per Shaffer's grading of angle.

ANGLE	NUMBER OF EYES
CLOSED	12
GRADE 1	42
GRADE 2	26

TRABECULAR IRIS ANGLE (TIA)

The quantitative grading of temporal angle of all eyes were done with UBM.They were grouped into three – eyes with TIA <10 degrees, 10 – 20 degrees and 20 – 30 degrees.

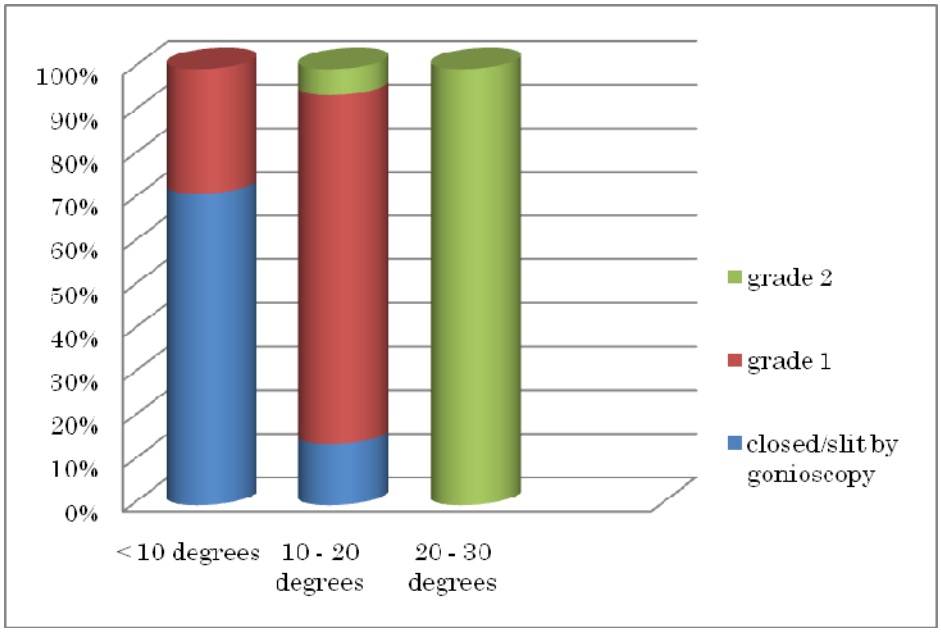
ANGLE	NUMBER OF EYES
< 10 degrees	7
10 – 20 degrees	50
20 – 30 degrees	23

COMPARISON OF TIA & GONIOSCOPIC GRADING

	CLOSED/ SLIT	GRADE 1	GRADE 2	TOTAL (eyes)
< 10 degrees	5	2	0	7
10 – 20 degrees	7	40	3	50
20 – 30 degrees	0	0	23	23

5 out of 7 eyes with TIA <10 degrees gonioscopically had closed or slit angles.40 out of 50 eyes with TIA 10 - 20 degrees gonioscopically had grade 1 angle.All 23 eyes with TIA 20 - 30 degrees gonioscopically had grade 2 angle.

Gonioscopy of 68 eyes out of 80 eyes (85%) correlated well with quantitative angle estimation – TIA.



TIA & GONIOSCOPY COMPARISON

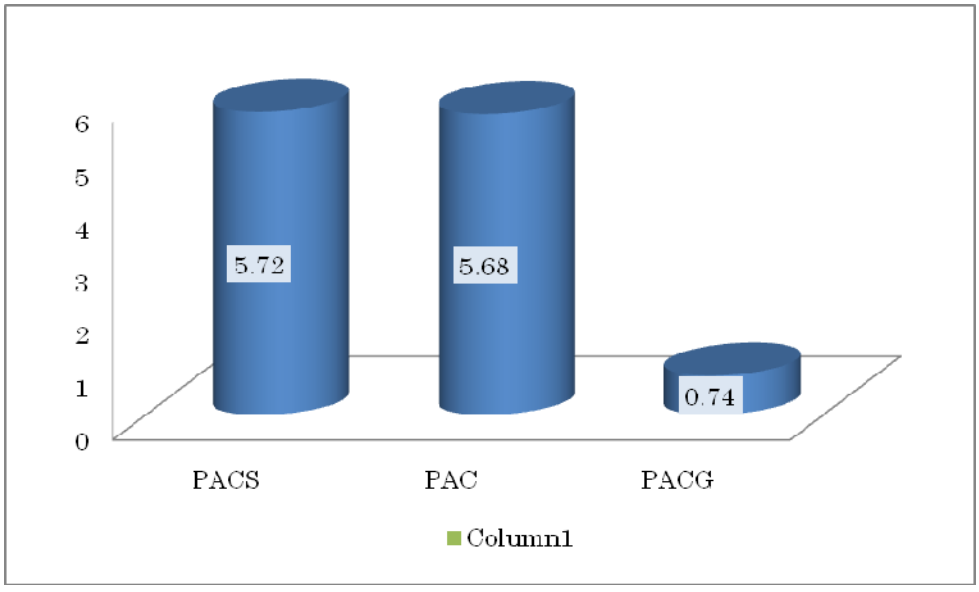
CHANGES IN UBM PARAMETERS FOLLOWING LPI

TRABECULAR IRIS ANGLE (TIA)

The average of difference in values of TIA of eyes with PACS, PAC and PACG before and after undergoing laser iridotomy were as follows

EYES	PACS		PAC		PACG	
DIFFERENCE IN TIA (degrees)	Average	SD	Avearge	SD	Average	SD
	5.72	2.99	5.68	4.68	0.74	0.82

SD – Standard Deviation

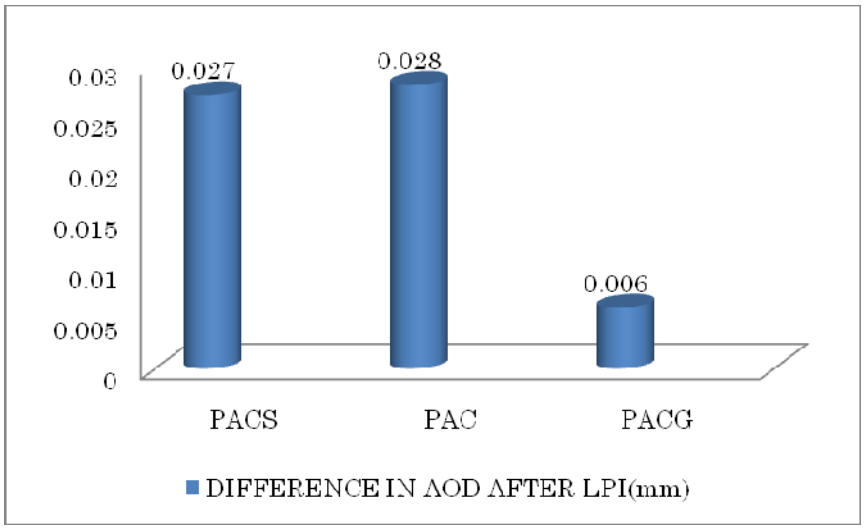


CHANGES IN TIA FOLLOWING LPI

ANGLE OPENING DISTANCE (AOD500)

The average of difference in values of AOD500 of eyes with PACS, PAC and PACG before and after undergoing laser iridotomy were as follows

EYES	PACS		PAC		PACG	
DIFFERENCE IN AOD500 (in mm)	Average	SD	Average	SD	Average	SD
	0.027	0.027	0.028	0.035	0.006	0.008

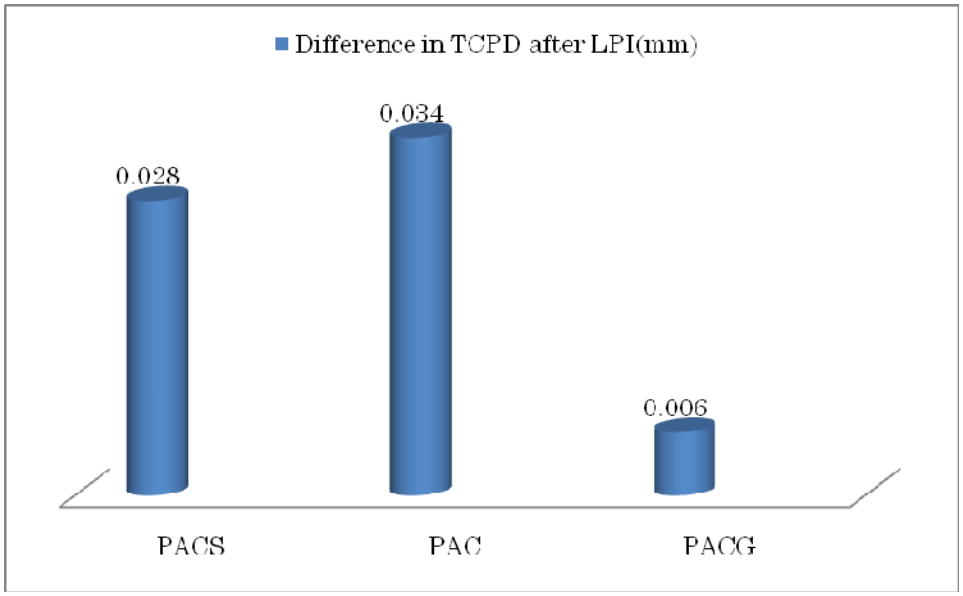


CHANGES IN AOD AFTER LPI

TRABECULAR CILIARY PROCESS DISTANCE (TCPD)

The average of difference in values of TCPD in eyes with PACS, PAC and PACG before and after undergoing laser iridotomy were as follows

EYES	PACS		PAC		PACG	
DIFFERENCE IN TCPD (in mm)	Average	SD	Average	SD	Average	SD
	0.028	0.029	0.034	0.044	0.006	0.007



CHANGES IN TCPD AFTER LPI

COMPARISON OF CHANGES IN PACS & PAC EYES WITH PACG EYES AFTER LPI

TIA

The changes in TIA following LPI in eyes in early stages of glaucoma -PACS, PAC were significant ($p<0.025$) compared to eyes in late stages of angle closure -PACG.

	PACS &PAC		PACG	
TIA (degrees)	Average	SD	Average	SD
	5.70	3.26	0.74	0.82

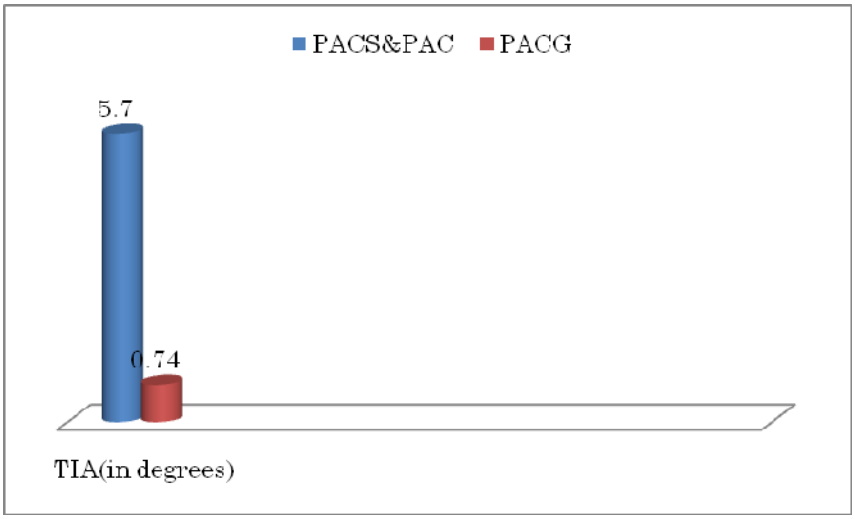
AOD & TCPD

In PACS and PAC eyes following LPI, AOD500 increased by 0.028mm ($p<0.1$) & TCPD increased by 0.030mm ($p<0.1$) whereas in eyes with PACG, AOD500 and TCPD increased by 0.006 mm.

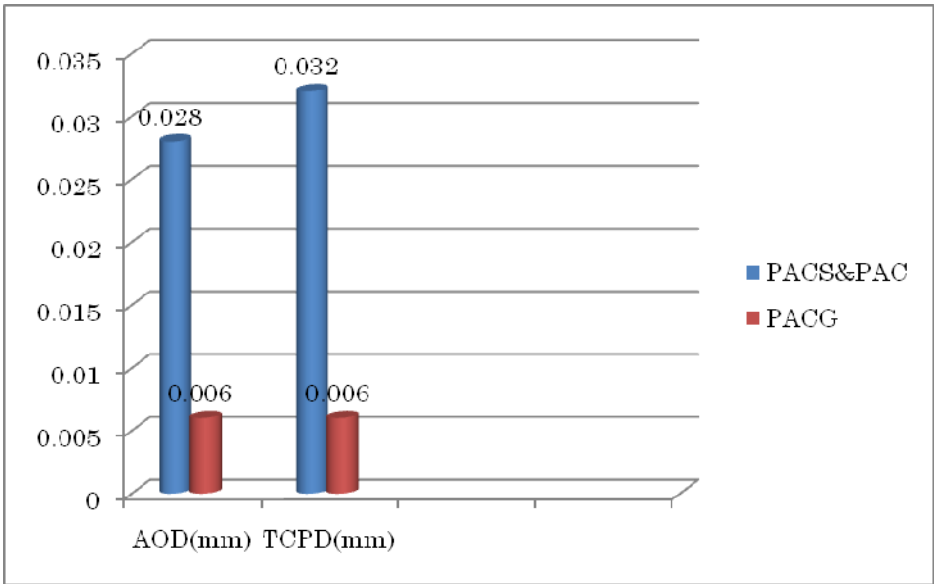
	PACS &PAC		PACG	
	Average	SD	Average	SD
AOD(mm)	0.028	0.028	0.006	0.008
TCPD(mm)	0.030	0.031	0.006	0.007

The average axial anterior chamber depth(ACD) of these eyes increased by 0.04mm following LPI.

COMPARISON OF CHANGE IN TIA AFTER LPI IN PACS&PAC EYES WITH PACG EYES



COMPARISON OF CHANGES IN AOD & TCPD AFTER LPI IN PACS&PAC EYES WITH PACG EYES



DISCUSSION

The incidence and prevalence of Primary angle closure disease in a population are influenced by a number of factors including patients age, gender, refractive status of the eye and heredity.

Ocular risk factors cluster around a variety of findings like shallow anterior chamber, decreased anterior chamber volume, short axial length of the globe, small corneal diameter, anterior position of the lens with respect to the ciliary body, increased curvature of the anterior lens surface and increased thickness of the lens.

This study has been done with the aim of analysing the risk factors for Primary angle closure disease. 90% of the study group were *above 40 years* of age and 10% were below 40 years. This shows the prevalence of angle closure disease increases after the age of 40 years as shown in previous studies[33,35].The sex distribution was 51% females and 49% males.

74% of the subjects were from *urban* area and 26% were from rural locality. This may be explained by increased awareness and easy access to health care services in urban area when compared to rural areas. The

Chennai glaucoma study by Vijaya et al[8] also had showed increased prevalence of primary angle closure in the urban population.

33% of the subjects were *diabetic*. In addition to Primary open angle glaucoma, Diabetes mellitus is also a risk factor for primary angle closure disease.[32] Rapid correction of hyperglycemia is a precipitating factor of acute angle closure attack[33].

The prevalence of primary angle closure disease is higher in *hyperopic* eyes, 60% of the eyes included in the study were hyperopic. 61% of the eyes had an *axial length* of less than 23mm which is consistent with other studies showing that patients with short axial length are at more risk of developing primary angle closure disease than the normal subjects[36,37]. *Shallow anterior chamber depth* (ACD) is an important risk factor to angle closure. An ACD of less than 2.5mm predisposes patients to primary angle closure[10-12]. 39% of the eyes had an ACD <2.5mm and 37% had an ACD <2.0mm.

Gonioscopy remains the mainstay of diagnosing narrow angles. The Shaffer grading system is universally used to assess the risk of angle closure. However, being a subjective examination, it provides only a qualitative assessment of the angle width.

The ultrasoundbiomicroscopy (UBM) of the anterior segment has been used to quantitatively assess the iris curvature and degree of angle opening, since it images a cross-section of angle structures similar to that of a low power microscope. The role of UBM as a useful quantitative tool has been evaluated by various authors.[12,26,27]

In 85% of our eyes, gonioscopic angle evaluation correlated with quantitative angle estimation by UBM. Studies by Susmitha et al[28] and Narayanaswamy et al[29] have shown that UBM measurements correlated significantly with the gonioscopic assessment of angle width.

15% of the angles which did not correlate were very narrow. Iris contour does play a major role in the subjective appearance of the angle recess width in comparison with its estimation by UBM, and this could explain misjudgement in subjective estimation, especially in the angles that are more occludable , where the iris contours tend to be more convex.

Eventhough gonioscopy is a subjective method of assessing the angle, it is a reliable and useful method of grading and evaluating the anterior chamber angle when done by an experienced person.

Laser peripheral iridotomy (LPI) is the standard first line intervention for angle closure[30]. It prevents the recurrence of acute

episodes and eliminates the risk of acute attacks in fellow eyes. The general configuration of the iris in normal patients is planar or has a gentle anterior convexity[31]. A relative pupillary block results in an anteriorly bowed iris, with a corresponding decrease in angle opening. By allowing aqueous to flow directly through the iridotomy site, LPI equilibrates the pressure between the anterior and posterior chambers. Eliminating this pressure gradient flattens the iris, allowing the peripheral iris to fall backward, resulting in wider angle configuration.

Angle opening distance at 500microns from scleral spur (AOD500) is a measure of the angle opening at the level of the anterior Schwalbe's line. It may thus reflect the amount of relative pupillary block in eyes with narrow angles.[32]

Trabecular ciliary process distance (TCPD) defines the space available for the iris between the trabecular meshwork and ciliary process and is a typical feature in an individual eye. The TCPD is the sum of three segments: AOD500, the thickness of the iris at that point and the width of the ciliary sulcus. An anteriorly placed ciliary process or a thick iris can reduce the peripheral anterior chamber depth and make it susceptible to occlusion.

In PACS and PAC eyes following LPI,

- TIA widened by a mean of 5.70 degrees .
- AOD500 increased by 0.028mm .
- TCPD increased by 0.030mm.

In eyes with PACG, TIA widened only by 0.74 degrees and AOD500 and TCPD increased by 0.006mm.

The results are consistent with previous studies. Dada[24] et al have published in a study that LPI leads to a widening of the anterior chamber angle in eyes with PAC and it does not significantly change any anterior segment parameters in eyes with PACG. Another study by Friedman[15] et al have shown that LPI results in an increase of AOD and TCPD by around 20microns in 36% of the eyes with PACS.

Axial anterior chamber depth increased by a mean of 0.04mm after LPI which is consistent with other studies[16,20-22] showing that ACD does not vary significantly following LPI.

LPI results in a significant change in angle parameters in eyes in early stages of angle closure than in eyes in late stage of PACG.

LPI relieves only the component of pupillary block in eyes with angle closure. So prophylactic LPI may be less effective in eyes where pupillary block is one of the several mechanisms causing angle closure. Anterior rotation of the ciliary body, more anterior iris insertion and a thick peripheral iris roll are the possible nonpupillary block mechanisms that may lead to post-LPI residual angle closure.

CONCLUSION

- Individuals aged above 40 years, females and diabetics are at more risk for the angle closure disease .

- Ocular risk factors for angle closure are hyperopia, short axial length and shallow anterior chamber depth.

- Gonioscopy is reliable and equally effective in grading the anterior chamber angle as compared to quantitative angle estimation by UBM.

- Access to quantitative anterior chamber angle evaluation is complimentary.

- Laser peripheral iridotomy proves to be a boon for the eyes with angle closure disease in its early stages.

Since visual loss resulting from PACG is potentially preventable, careful surveillance for risk factors of angle closure, widespread use of gonioscopy to identify occludable angles and peripheral iridotomy performed at an early stage can reduce the morbidity resulting from PACG.

Increasing the awareness among the rural population, training the health care professionals in the peripheries to do the simple technique of gonioscopy and thereby aiding in early diagnosis and intervention of Primary angle closure disease, irreversible vision loss due to PACG can be reduced to a large extent.

FUTURE SCOPE OF THE STUDY

By analysing the lens thickness and its position in relation to ciliary body, the role of lens morphology in Primary angle closure disease can be studied. By following up the PACS subjects with LPI over a longer period, the role of LPI in the natural course of the disease and its contribution to the progression of cataract can be assessed.

S. No.	NAME	AGE	LOCATION	SEX	DM	HT	FH	EYE	CATEGORY	HYPERMETROPE	IOP	LENS	CD RATIO	A SCAN		ACD-UBM	BEFORE PI (TEMPORAL ANGLE)					AFTER PI(TEMPORAL ANGLE)				
														AL	AC DEPTH		GONIO	TIA	AOD	TCPD	ACD	GONIO	TIA	AOD	TCPD	ACD
1	DEVAKI	60	R	F	N	N	N	RE	PACS	Y	14	IMC	0.4	21.81	2.07	1.92	1	12	0.21	0.69	1.92	2	20.4	0.23	0.72	2.07
2								LE	PACG	N	28	IMC	0.9	22.12	2.11	1.93	C	4	0.07	0.53	1.93					
3	GOKILA	49	U	F	Y	N	N	RE	PACS	Y	16	CLEAR	0.4	22.01	2.44	2.03	2	24.6	0.25	0.71	2.03	2	29.2	0.27	0.75	2.14
4								LE	PACS	Y	16	CLEAR	0.4	22.02	2.63	2.18	2	24	0.25	0.71	2.18	2	31.7	0.28	0.74	2.18
5	SRINIVASAN	44	U	M	N	N	N	LE	PACS	N	14	CLEAR	0.3	22.12	2.3	2	1	10	0.14	0.69	2	2	15	0.17	0.69	2.18
6	RIAZ AHAMED	52	U	M	Y	Y	N	RE	PACS	N	12	CLEAR	0.4	22.08	2.28	2.15	1	15.2	0.18	0.72	2.15	2	19.4	0.22	0.74	2.25
7								LE	PACS	Y	14	CLEAR	0.3	21.67	2.25	2.22	2	14.5	0.17	0.72	2.22	2	19.9	0.25	0.79	2.22
8	YASODHA	60	U	F	N	N	N	RE	PACS	N	16	CLEAR	0.3	21.22	2.22	2.22	1	19.4	0.2	0.7	2.22	2	20.2	0.21	0.73	2.22
9								LE	PACS	Y	14	CLEAR	0.3	21.57	2.25	2.25	2	20.8	0.23	0.68	2.25	2	23.7	0.23	0.7	2.26
10	VASANTHA	54	U	F	N	N	N	RE	PACS	Y	18	IMC	0.4	23.08	2.44	2	C	12.9	0.15	0.69	2	2	27	0.23	0.75	2.07
11								LE	PACS	Y	14	IMC	0.3	22.96	2.85	2.42	1	18.3	0.18	0.71	2.42	2	23.7	0.25	0.75	2.48
12	VASANTHI	45	U	F	Y	N	Y	RE	PACS	Y	12	CLEAR	0.4	23.5	2.47	2.44	1	11.4	0.13	0.68	2.44	1	11.7	0.13	0.69	2.44
13								LE	PACS	Y	12	CLEAR	0.4	23.16	2.4	2.37	1	18.6	0.17	0.73	2.37	2	18.6	0.17	0.73	2.37
14	MEERA	51	U	F	Y	N	N	RE	PACS	Y	16	IMC	0.3	21.06	2	1.69	C	7.8	0.1	0.61	1.69	C	8.8	0.1	0.61	1.69
15								LE	PACS	Y	16	IMC	0.3	21.24	1.86	1.74	1	13	0.14	0.68	1.74	2	23	0.26	0.8	1.77
16	SELVARAJ	60	R	M	N	N	N	RE	PAC	Y	16	IMC	0.3	23.52	2.12	2.1	1	18.1	0.26	0.79	2.1	2	28.2	0.29	0.82	2.11
17								LE	PACS	Y	20	IMC	0.3	23.4	2.42	2.23	2	20.4	0.19	0.72	2.23	2	27.1	0.22	0.74	2.26
18	SUBASH	28	U	M	N	N	N	RE	PAC	N	58	CLEAR	0.4	23.29	2.48	3	C	2	0.02	0.56	3	2	18	0.13	0.69	3
19								LE	PACS	N	16	CLEAR	0.3	22.91	3.63	3.6	1	17	0.18	0.72	3.6	2	24	0.2	0.74	3.61
20	Dr.SHANMUGASUNDARI	46	U	F	N	Y	N	RE	PACS	N	12	CLEAR	0.3	21.8	2.7	2.79	2	22.6	0.16	0.58	2.79					
21								LE	PACS	N	16	CLEAR	0.3	22.14	2.72	2.82	2	20.3	0.16	0.57	2.82					
22	RAMACHANDRAN	55	U	M	N	N	N	RE	PACS	Y	10	IMC	0.2	22.5	1.85	1.73	C	10.2	0.09	0.55	1.73	2	20.1	0.15	0.62	1.75
23								LE	PACS	Y	12	IMC	0.2	22.34	1.8	1.69	C	11.7	0.11	0.56	1.69	2	19.8	0.13	0.57	1.7
24	KASTHURI	61	U	F	N	N	N	RE	PACG	Y	18	IMC	0.6	22.51	2.74	2.1	1	18.2	0.16	0.69	2.1	1	18.9	0.16	0.69	2.1
25								LE	PACS	Y	18	IMC	0.3	22.63	2.81	1.96	1	17.5	0.15	0.68	1.96	2	23	0.17	0.71	2
26	RASIYA	49	U	F	N	N	N	RE	PACS	N	18	IMC	0.4	21.77	2.49	2.14	2	24.7	0.26	0.74	2.14	2	29.7	0.29	0.81	2.16
27								LE	PACG	N	18	IMC	0.7	21.91	2.68	2.26	1	18.2	0.16	0.7	2.26	1	18.6	0.16	0.7	2.26
28	ARUMUGAM	62	U	M	Y	N	N	RE	PACS	N	16	CLEAR	0.3	21.87	2.59	1.99	1	11.3	0.21	0.71	1.99	2	20.4	0.24	0.75	2
29								LE	PACS	N	14	CLEAR	0.3	21.8	2.52	2	1	13.3	0.27	0.78	2	2	22.3	0.28	0.78	2.02
30	LAKSHMANAN	51	U	M	Y	N	N	RE	PACS	Y	16	IMC	0.3	21.22	2.22	1.84	1	12.7	0.15	0.68	1.84	1	18	0.16	0.72	1.86
31								LE	PACS	Y	16	IMC	0.3	21.29	2.26	1.88	1	19.1	0.19	0.7	1.88	2	25.3	0.21	0.7	1.89
32	PREMAKUMARI	56	U	F	N	N	N	RE	PACS	Y	16	CLEAR	0.3	21.72	2.15	2.05	1	13.2	0.17	0.67	2.05	2	24.6	0.21	0.69	2.07
33								LE	PACS	Y	16	CLEAR	0.3	21.65	2.15	2.1	1	15.4	0.18	0.69	2.1	2	25.2	0.22	0.74	2.14
34	SABIRA	48	U	F	N	N	N	RE	PACS	Y	12	CLEAR	0.3	23.27	2.63	2.3	1	12	0.15	0.59	2.3	1	17	0.16	0.62	2.37
35								LE	PACS	Y	20	CLEAR	0.3	23.09	2.78	2.3	1	15	0.16	0.6	2.3	2	22	0.16	0.61	2.41
36	MUNIAMMAL	70	R	F	N	N	N	RE	PACS	N	18	IMC	0.4	22.86	2.3	1.99	1	10.7	0.1	0.58	1.99	2	17	0.13	0.6	2.03
37	SHANMUGAM	58	U	M	N	N	N	RE	PACS	Y	14	IMC	0.3	24.02	1.96	1.39	1	14.2	0.13	0.61	1.39	1	19.8	0.14	0.61	1.43
38								LE	PACS	Y	18	IMC	0.3	24.05	1.87	1.43	C	8	0.09	0.57	1.43	C	10	0.09	0.57	1.43
39	MANOHARAN	52	R	M	N	N	N	LE	PACS	N	10	IMC	0.2	23.81	1.5	1.04	1	9.2	0.08	0.55	1.04	1	10.6	0.08	0.55	1.07
40	SRIDHARLAL	53	U	M	Y	N	N	RE	PACS	Y	12	CLEAR	0.2	23.92	1.56	1.32	1	15.9	0.18	0.61	1.32	2	25.7	0.2	0.62	1.95

41								LE	PACS	N	12	IMC	0.3	23.89	2.04	1.84	1	18.6	0.19	0.61	1.84	2	22.9	0.19	0.61	1.89
42	HAMSA	60	R	F	N	Y	N	RE	PACS	Y	20	IMC	0.3	23.21	2.43	2.22	2	23.3	0.24	0.72	2.22	3	24.8	0.24	0.72	2.22
43								LE	PACS	Y	16	IMC	0.3	23.14	2.4	2.18	1	19.3	0.22	0.7	2.18	2	21.5	0.23	0.7	2.18
44	JANAGAVALLI	57	U	F	N	N	N	RE	PACS	Y	18	IMC	0.2	21.37	2.15	2.1	2	20.9	0.18	0.61	2.1	2	27.1	0.24	0.71	2.12
45								LE	PACS	Y	16	IMC	0.2	21.47	2.29	2.18	2	22.4	0.23	0.65	2.18	2	26.4	0.26	0.71	2.2
46	SARDHA	62	U	F	Y	N	N	RE	PACS	Y	20	IMC	0.3	22.07	2.03	1.88	2	21	0.22	0.65	1.88					
47								LE	PACS	Y	18	IMC	0.3	22.44	1.97	1.88	2	20.6	0.22	0.64	1.88					
48	M.IBRAHIM	37	U	M	N	Y	N	RE	PACG	N	24	CLEAR	0.9	23.02	2.92	2.37	C	11.3	0.15	0.57	2.37					
49								LE	PACS	N	16	CLEAR	0.3	23.86	2.63	2.29	2	20.3	0.17	0.61	2.29	2	26	0.19	0.62	2.31
50	PALAMMAL	45	R	F	N	N	N	LE	PACS	N	12	CLEAR	0.3	21.44	2.15	1.61	1	17.9	0.18	0.63	1.61	2	25.9	0.26	0.71	1.8
51	VITTAL	74	U	M	Y	N	N	RE	PACS	Y	16	IMC	0.3	22.6	2.35	1.77	1	16.8	0.17	0.61	1.77	2	24.9	0.19	0.62	1.78
52								LE	PAC	N	24	IMC	0.3	22.54	2.2	1.61	C	11.4	0.17	0.61	1.61	1	22.6	0.18	0.62	1.61
53	THIRUNAVUKARASU	61	U	M	N	N	N	RE	PACG	Y	14	IMC	0.6	23.3	2	1.43	1	17.4	0.19	0.63	1.43	1	18.2	0.2	0.64	1.43
54								LE	PACS	Y	12	IMC	0.3	23.42	2.12	1.81	2	20	0.21	0.73	1.81	2	24.3	0.24	0.77	1.81
55	SRINIVASAN	49	U	M	N	N	N	RE	PAC	N	22	IMC	0.4	22.56	2.18	1.77	1	13	0.15	0.61	1.77	1	15.1	0.17	0.64	1.84
56								LE	PAC	Y	24	IMC	0.3	23.02	2.1	1.73	1	10.4	0.12	0.61	1.73	1	14.4	0.13	0.61	1.81
57	VENKATESAN	43	U	M	Y	Y	N	RE	PAC	N	14	CLEAR	0.3	24.06	3.4	3.14	1	16.4	0.18	0.63	3.14	2	24.2	0.22	0.67	3.14
58								LE	PAC	N	16	CLEAR	0.4	23.96	3.4	3.14	1	10.2	0.12	0.63	3.14	1	14.4	0.14	0.65	3.14
59	USHARANI	50	R	F	N	N	N	LE	PAC	Y	28	CLEAR	0.3	21.59	2.2	1.69	1	11	0.14	0.68	1.69	1	12	0.14	0.69	1.77
60	KARUPANAN	62	U	M	Y	Y	N	RE	PACG	Y	20	IMC	0.7	23.89	1.9	1.92	2	20.9	0.22	0.69	1.92	2	24.5	0.25	0.71	1.92
61								LE	PACG	Y	20	IMC	0.8	22.06	1.8	1.84	2	24.3	0.25	0.72	1.84	2	25	0.26	0.73	1.84
62	MEENAMAL	48	R	F	Y	N	N	RE	PACG	Y	42	IMC	0.9	21.14	2.3	2.3	1	12	0.16	0.59	2.3					
63								LE	PACG	Y	24	IMC	0.8	21.34	2.23	2.3	2	21.6	0.27	0.76	2.3	2	22.3	0.28	0.78	2.3
64	JANARTHANAN	65	U	M	N	N	N	RE	PACG	Y	14	IMC	0.9	23.18	2.4	2.33	1	17	0.18	0.7	2.33					
65								LE	PACG	Y	18	IMC	0.7	23.81	2.4	2.33	1	15.5	0.17	0.67	2.33	1	16	0.17	0.67	2.33
66	RAJENDRAN	60	U	M	N	N	N	RE	PACG	N	16	IMC	0.8	24.14	3.07	2.63	2	23.2	0.23	0.71	2.63	2	24	0.23	0.71	2.63
67								LE	PACG	N	16	IMC	0.7	24.02	3.15	2.64	2	24.2	0.25	0.74	2.64	2	24.5	0.25	0.74	2.64
68	ANBUKALINGAVARDHAN	40	U	M	N	N	Y	RE	PACG	N	14	CLEAR	0.9	22.85	3	2.82	C	9.2	0.1	0.6	2.82					
69								LE	PACG	N	14	CLEAR	0.8	22.98	3	2.82	1	13.2	0.16	0.61	2.82	1	13.4	0.17	0.62	2.82
70	MUNIAMMAL	49	R	F	N	N	N	RE	PACG	N	16	IMC	0.5	22.58	2.33	2.03	C	14	0.17	0.69	2.03	1	14	0.18	0.69	2.03
71								LE	PACG	N	16	IMC	0.8	22.62	2.52	2.05	C	14.5	0.18	0.68	2.05	C	18.7	0.2	0.7	2.07
72	SATHYAVANI	55	U	F	Y	N	N	RE	PACG	N	12	IMC	0.7	21.74	3	3	2	20.1	0.2	0.7	3	2	21.5	0.2	0.71	3
73								LE	PACG	N	24	IMC	0.7	22.15	2.52	2.7	2	19	0.19	0.69	2.7	2	20.7	0.2	0.69	2.9
74	SUMATHY	32	U	F	N	N	N	RE	PACG	N	40	CLEAR	0.8	23.72	2.64	2.8	2	23.7	0.25	0.78	2.8	2	24	0.25	0.78	2.8
75								LE	PACG	N	38	CLEAR	0.8	23.39	3.2	2.8	2	26.8	0.26	0.79	2.8	3	28.2	0.27	0.8	2.8
76	DEVADAS	43	U	M	N	N	N	RE	PACG	Y	14	CLEAR	0.5	24.1	2.8	2.6	2	22.5	0.23	0.65	2.6	2	23.1	0.24	0.65	2.6
77								LE	PACG	Y	14	CLEAR	0.7	24.03	2.8	2.64	2	29.1	0.26	0.8	2.64	2	29.2	0.26	0.8	2.64
78	MANIKAM	71	R	M	Y	N	N	RE	PACG	Y	18	IMC	0.8	22.42	2.68	2.71	1	11.4	0.17	0.61	2.71	1	11.4	0.17	0.61	2.71
79								LE	PACG	Y	14	IMC	0.8	22.98	2.85	2.82	1	11.5	0.17	0.61	2.82	1	11.9	0.17	0.61	2.82
80	JAGADESWARI	65	R	F	N	N	N	LE	PACG	Y	18	IMC	0.9	22.85	2.82	2.56	1	18.4	0.19	0.65	2.56					

PROFORMA

NAME AGE SEX GC.NO

PRESENTING H/O	
DM,HT	
FAMILY H/O GLAUCOMA	
H/O SYSTEMIC/TOPICAL MEDICATIONS	
H/O SURGERY/YAG	
H/O TRAUMA	

	RE	**LE**
Vn (with refraction)		
Tn by applanation		
CONJUNCTIVA		
CORNEA		
AC DEPTH by Van Herick's		
IRIS		
PUPIL		
LENS		
FUNDUS		
GONIO		
AP		
A SCAN - AC DEPTH		
AXIAL LENGTH		

YAG PI	RE	LE
SITE		
DETAILS		

UBM **BEFORE YAG PI** **AFTER YAG PI**

	RE	LE	RE	LE
TIA				
AOD				
TCPD				
ACD				

2 WEEKS AFTER YAG PI

	RE	LE
Vn		
Tn		
AC DEPTH by Van Herick's		
PATENCY & QUADRANT OF PI		
GONIO		
A SCAN – AC DEPTH		

LIST OF SURGERIES PERFORMED

S.No	Name	Age/ sex	OP/IP No	Diagnosis	Surgery performed
1	Mani	52/M	34097	RE MC	RE ECCE with PCIOL
2	Mariammal	60/F	37650	LE IMC	LE ECCE with PCIOL
3	Karuppasamy	54/M	37994	RE MC	RE ECCE with PCIOL
4	Govindasamy	57/M	35078	RE IMC	RE ECCE with PCIOL
5	Sumathi	52/M	37009	RE IMC	RE ECCE with PCIOL
6	Sankarammal	55/F	32343	RE lacrimal abscess	RE incision and drainage
7	Rathika	18/F	32888	LE chalazion	LE incision and curettage
8	Pattamal	57/F	38908	RE MC	RE ECCE with PCIOL
9	Murugan	35/M	39564	RE partial thickness lid tear	RE lid tear suturing
10	Samiappan	52/M	42067	RE MC	RE ECCE with PCIOL
11	Nalini	55/F	43230	RE IMC	RE ECCE with PCIOL
12	Muniammal	65/F	45032	LE chronic dacryocystitis	LE Dacryocystectomy
13	Sambath	23/M	46078	RE exotropia	RE assisted squint surgery
14	Annamal	65/F	49997	LE MC	LE ECCE with PCIOL
15	Gangadharan	43/M	50134	LE corneal tear	LE Assisted corneal tear suturing
16	Manoharan	58/M	41002	RE Posttraumatic endophthalmitis	RE Evisceration
17	Parthasarathy	61/M	64562	RE IMC	RE SICS with PCIOL
18	Vedisamy	70/M	64993	LE IMC	LE SICS with PCIOL
19	Rajam	45/F	62911	LE chronic dacryocystitis	LE Dacryocystorhinostomy
20	Utharani	56/F	61222	RE IMC	RE SICS with PCIOL
21	Kumar	35/M	63064	LE pterygium	LE pterygium excision with conjunctival autograft
22	Paramanathan	53/M	64921	RE IMC	RE SICS with PCIOL
23	Sundarammal	65/F	65670	LE IMC	LE SICS with PCIOL

24	Kannan	43/M	60010	RE central leucoma	RE assisted optical keratoplaty
25	Jabamalai	58/M	63412	RE IMC	RE SICS with PCIOL
26	Duraisamy	64/M	67375	RE corneoscleral tear	RE corneoscleral tear suturing
27	Rosamma	57/F	69213	RE IMC	RE SICS with PCIOL
28	Singari	60/F	67940	LE postoperative endophthalmitis	LE intravitreal antibiotics
29	Munusamy	51/M	69923	LE lagophthalmos with exposure keratopathy	LE tarsorraphy
30	Thiagarajan	60/M	70232	RE IMC	RE SICS with PCIOL
31	Selvamani	54/F	71430	RE IMC	RE SICS with PCIOL
32	Sudha	14/F	70030	LE dermoid under upper lid	LE dermoid excision
33	Ayusha	58/F	71177	LE IMC	LE SICS with PCIOL
34	Sankar	43/M	75423	LE IOFB	LE assisted IOFB removal
35	Ganga	61/F	73490	RE IMC	RE SICS with PCIOL

ABBREVIATIONS

RE – Right eye

LE – Left eye

IMC – Immature cataract

MC – Mature cataract

ECCE – Extracapsular cataract extraction

SICS – Small Incisional Cataract Surgery

IOFB – Intraocular Foreign Body.

PCIOL – Posterior chamber intraocular lens.

KEY TO MASTER CHART

RE – Right eye, LE – Left eye

R – Rural, U – Urban

F – Female

M – Male

DM – Diabetes mellitus

HT – Hypertension

FH – Family history

Y – Yes, N – No

PACS – Primary Angle Closure Suspect

PAC – Primary Angle Closure

PACG - Primary Angle Closure Glaucoma

AL – Axial length (in mm)

C – Closed

TIA – Trabecular Iris Angle (in degrees)

AOD – Angle Opening Distance (in mm)

TCPD – Trabecular Ciliary Process Distance (in mm)

ACD – Anterior Chamber Depth (in mm)

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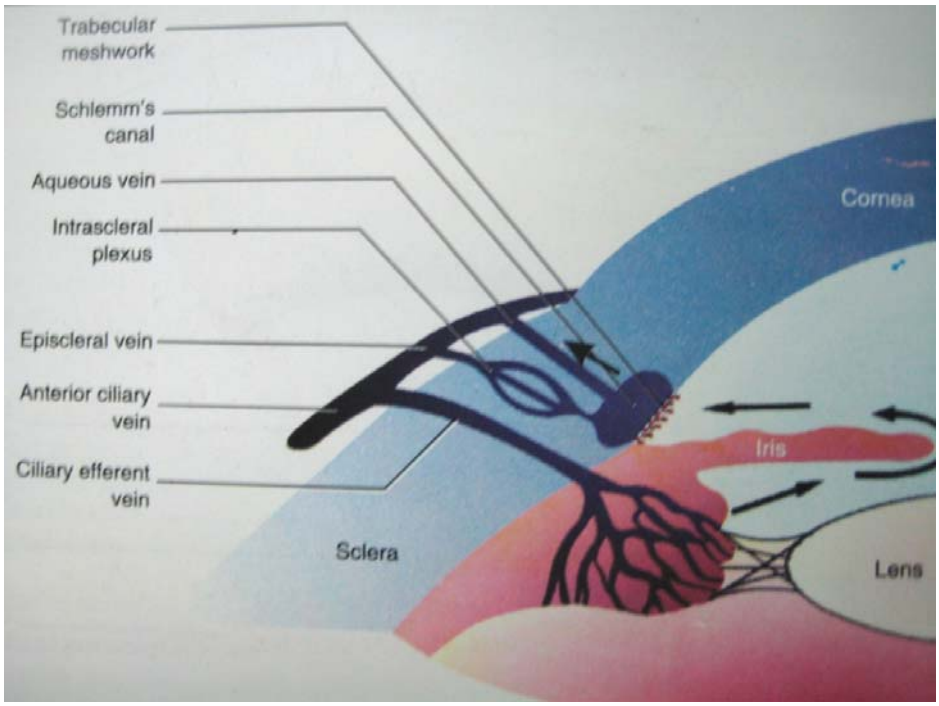
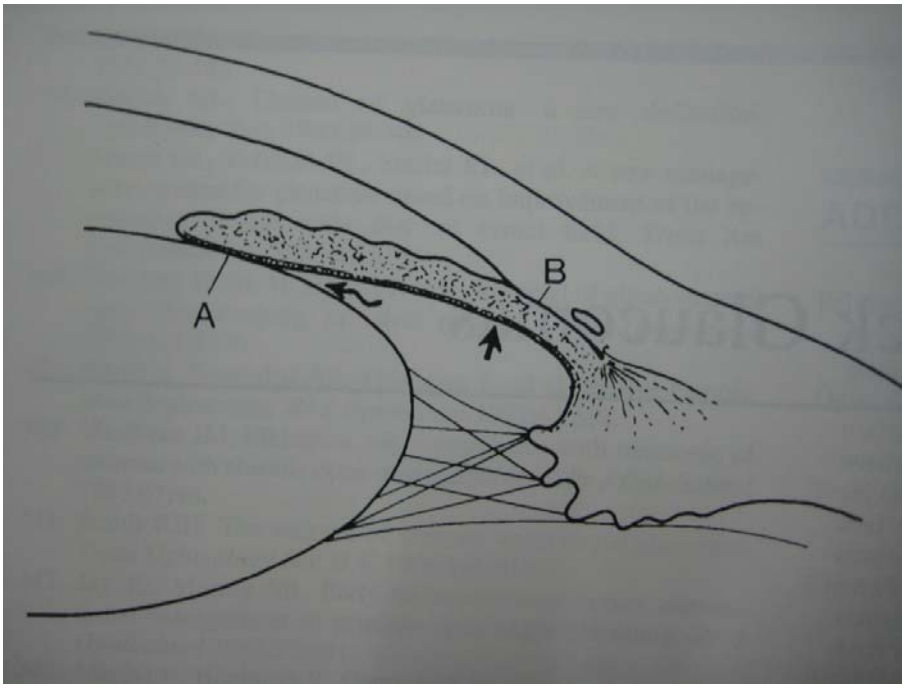
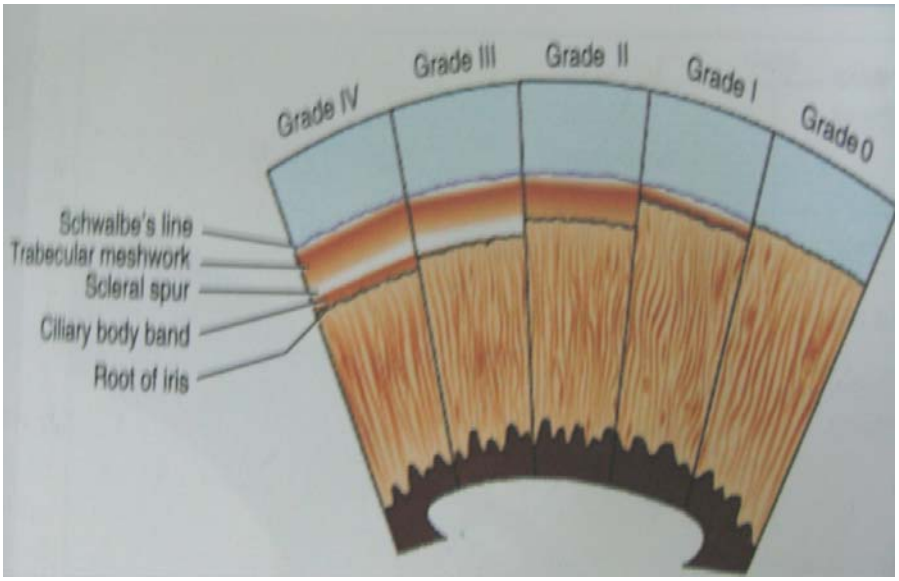
AQUEOUS OUTFLOW SYSTEM

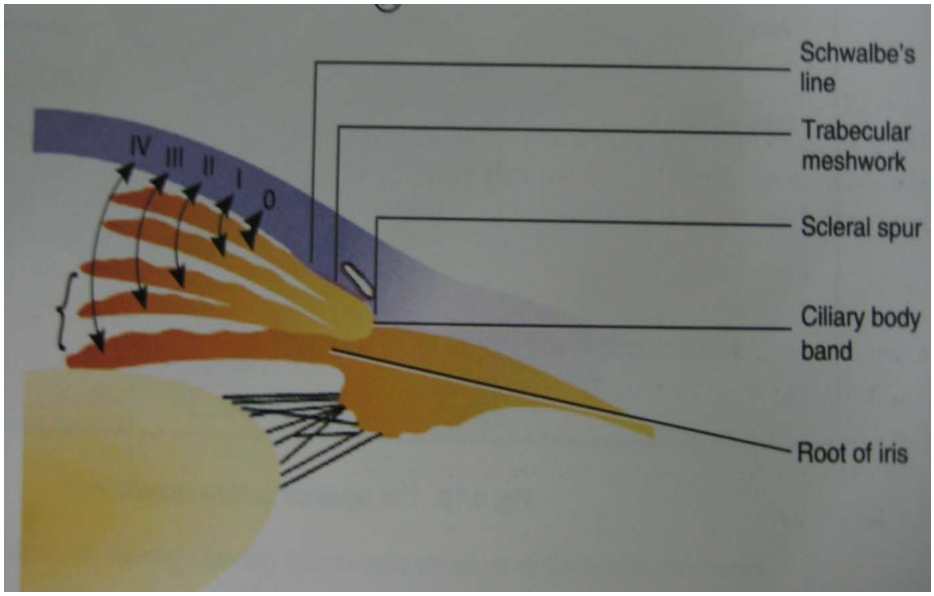


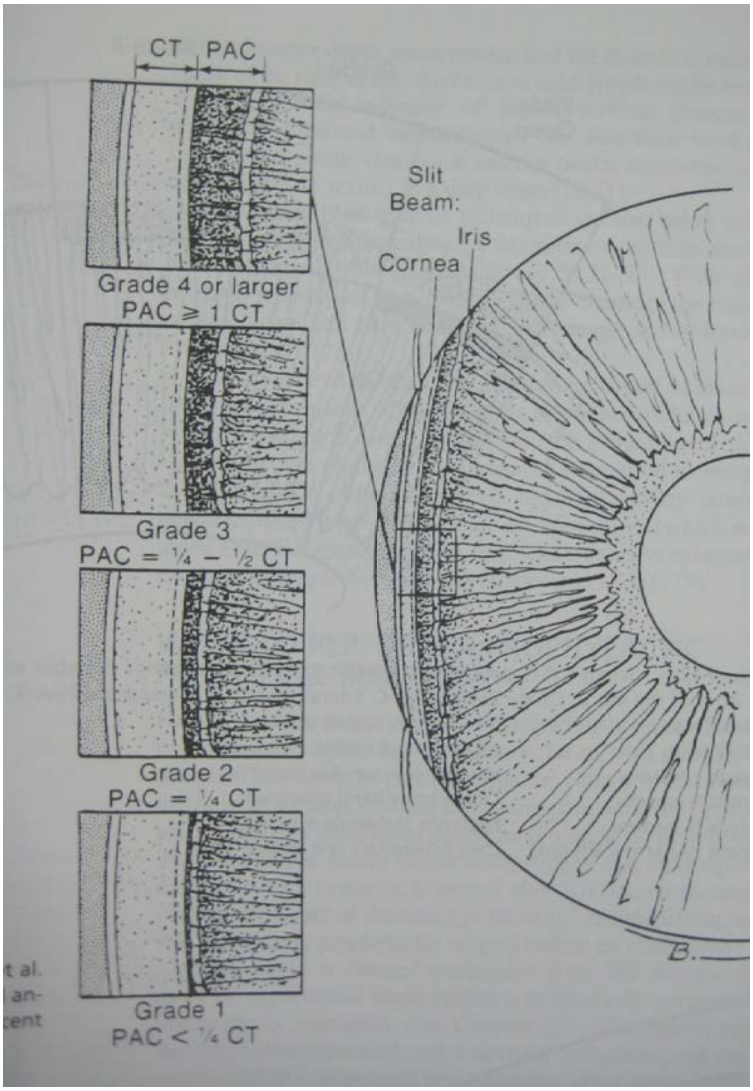
PUPILLARY BLOCK MECHANISM



SHAFFER'S GRADING OF ANGLES



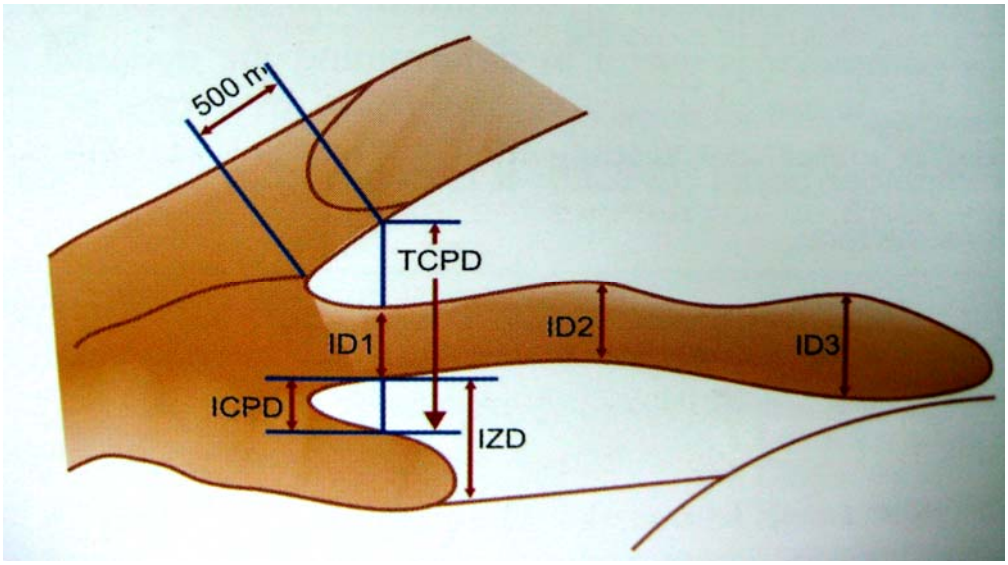


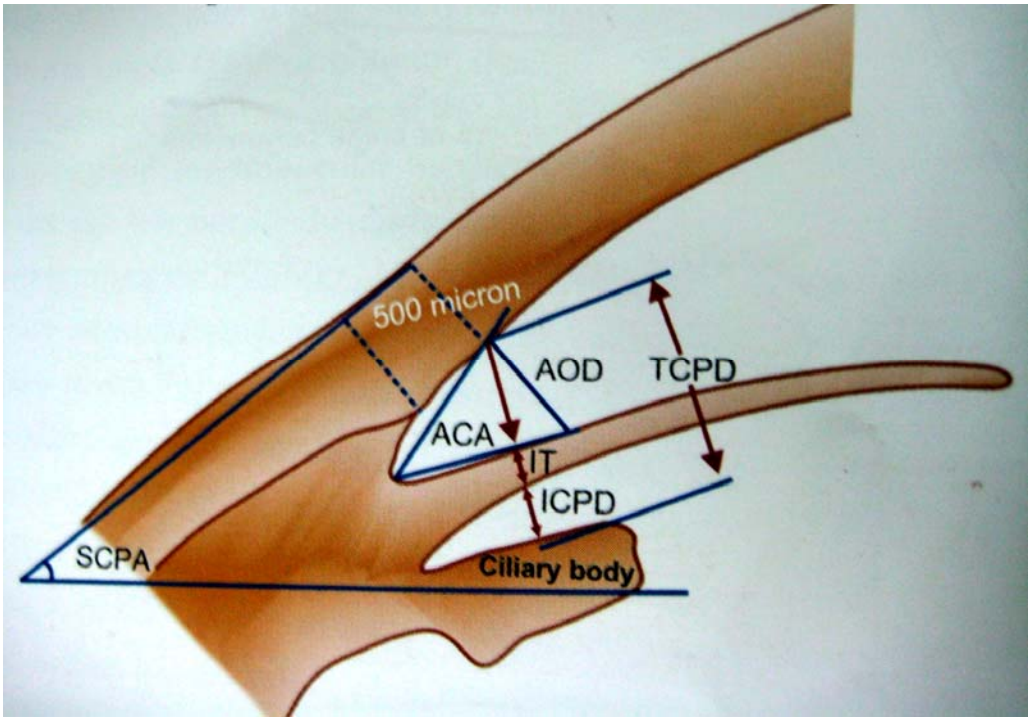


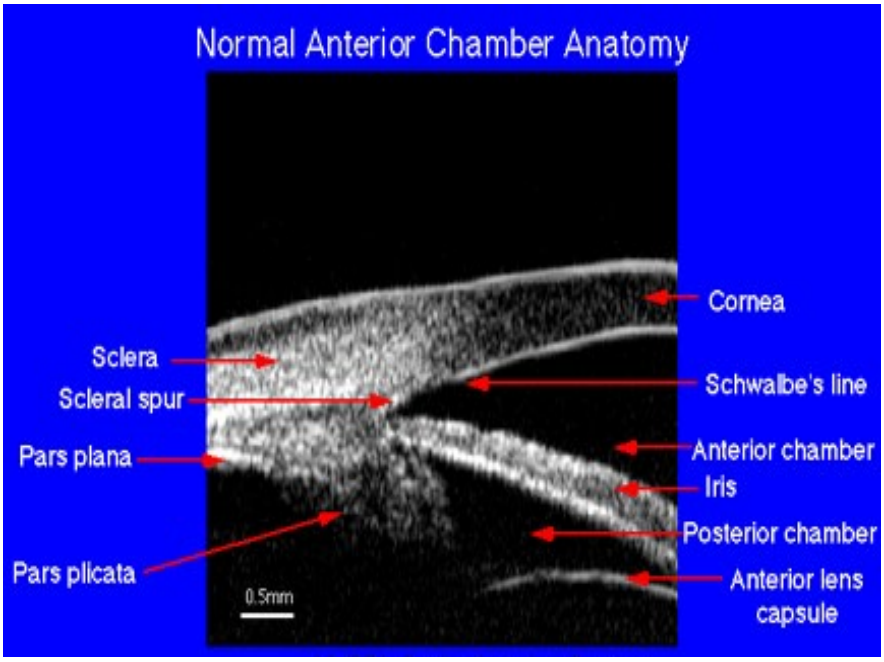
VAN HERICK'S GRADING OF ANTERIOR CHAMBER DEPTH

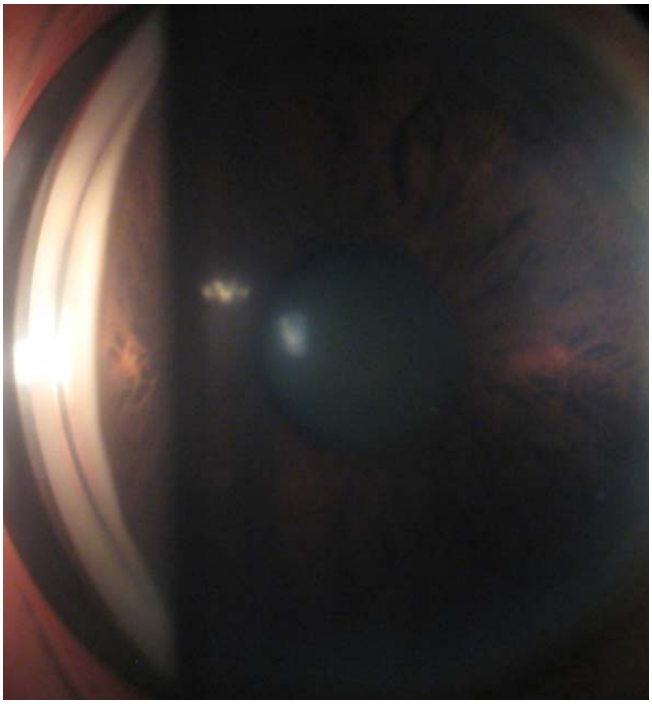
PARAMETERS

MEASUREMENT

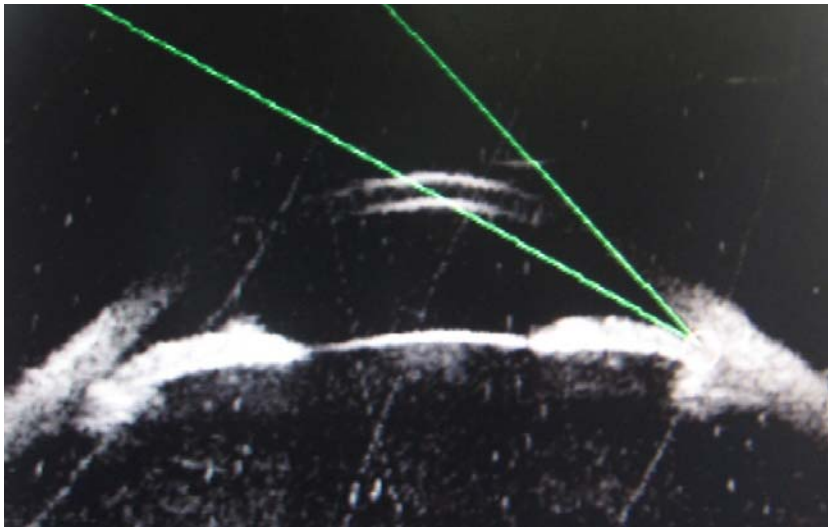




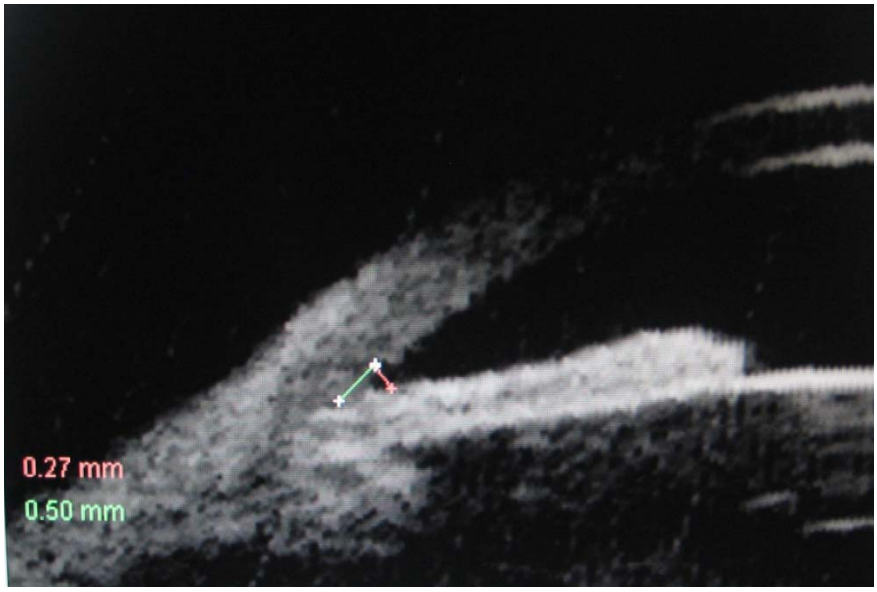

Normal Anterior Chamber Anatomy
Cornea
Sclera
Schwalbe's line
Scleral spur
Anterior chamber
Pars plana
Iris
Posterior chamber
Pars plicata
Anterior lens capsule
0.5mm



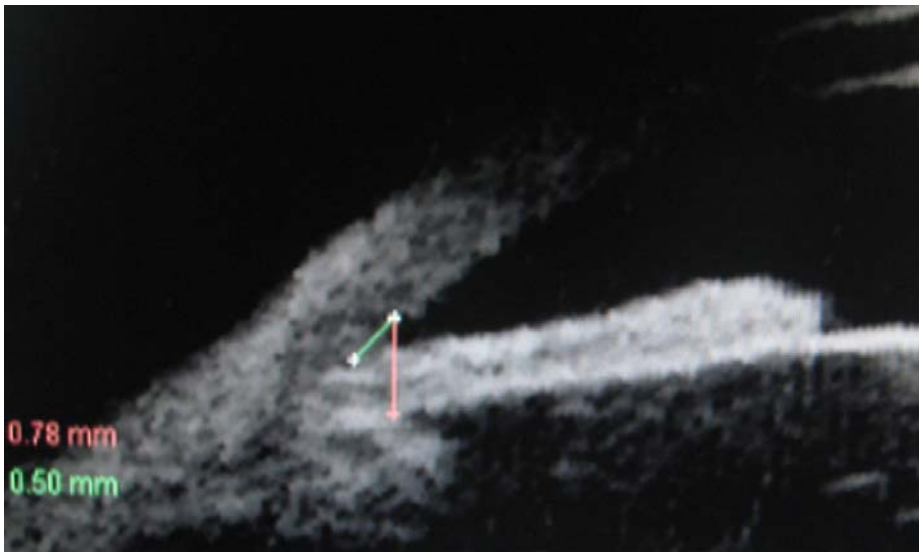
Gonioscopy picture – Grade 1 angle



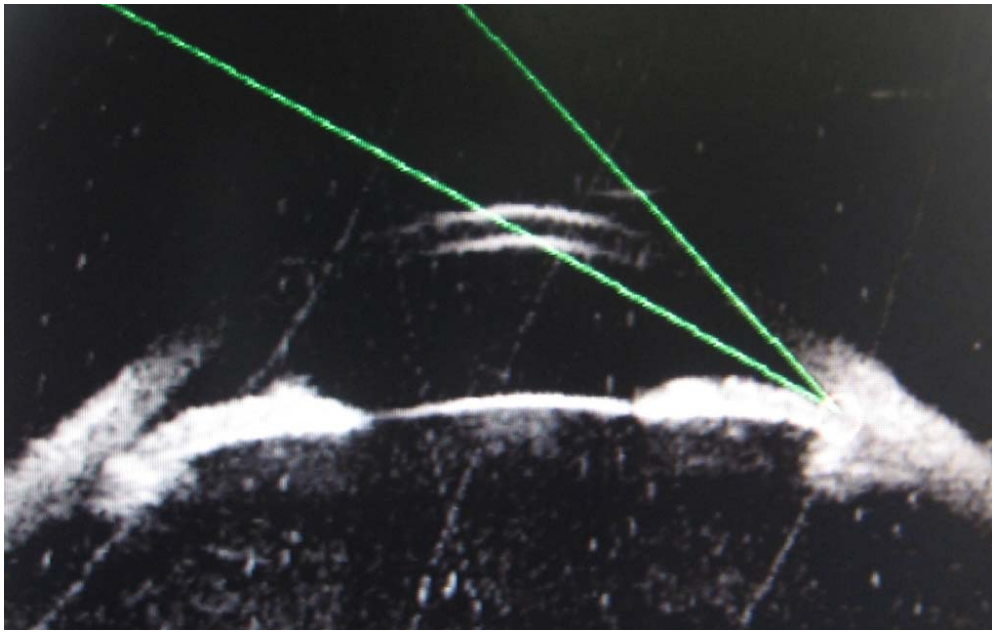
UBM picture of the same eye with TIA of 13.6 degrees



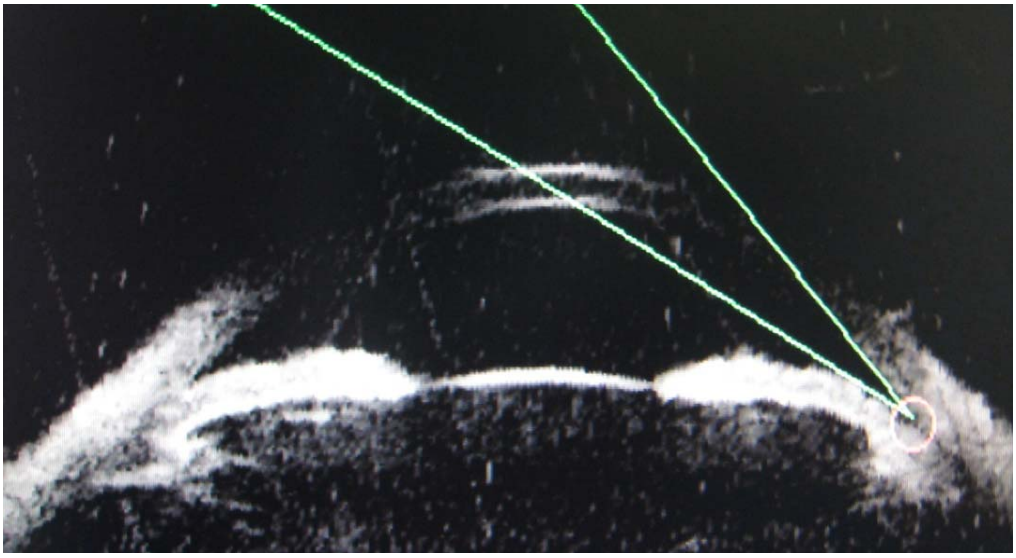
UBM PICTURE SHOWING AOD 500 MEASUREMENT



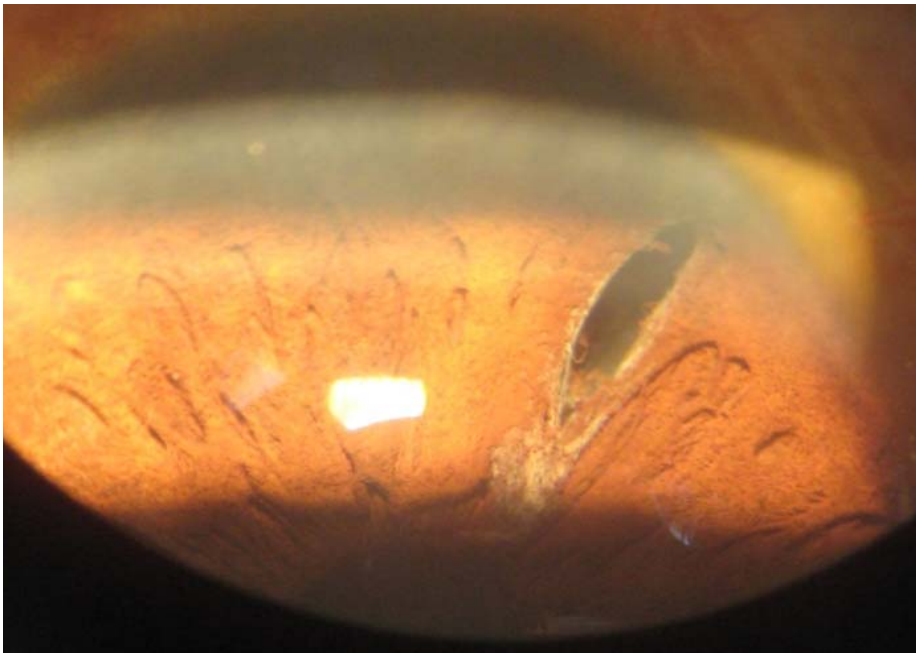
UBM PICTURE SHOWING TCPD MEASUREMENT



UBM picture showing TIA of 13.6 degrees before LPI.



UBM picture showing TIA of 17.3 degrees after LPI.



LASER IRIDOTOMY